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(11)

**EP 0 971 039 A3**

(12)

**EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:

**28.01.2004 Bulletin 2004/05**

(51) Int Cl.7: **C12Q 1/68, C12P 19/34**

(43) Date of publication A2:

**12.01.2000 Bulletin 2000/02**

(21) Application number: **99112181.5**

(22) Date of filing: **24.06.1999**

(84) Designated Contracting States:

**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE**

Designated Extension States:

**AL LT LV MK RO SI**

(30) Priority: **24.06.1998 US 104067**

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(54) **Processes useful for nucleic acid amplification and sequencing, and for the production of nucleic acid having decreased thermodynamic stability**

(57) This invention provides novel processes for amplifying nucleic acid sequences of interest, including linear and non-linear amplification. In linear amplification, a single initial primer or nucleic acid construct is utilized to carry out the amplification process. In non-linear amplification, a first initial primer or nucleic acid construct is employed with a subsequent initial primer or nucleic acid construct. In other non-linear amplification processes provided by this invention, a first initial primer or nucleic acid construct is deployed with a second initial primer or nucleic acid construct to amplify the specific nucleic acid sequence of interest and its complement that are provided. A singular primer or a singular nucleic acid construct capable of non-linear amplifi-

cation can also be used to carry out non-linear amplification in accordance with this invention. Post-termination labeling process for nucleic acid sequencing is also disclosed in this invention that is based upon the detection of tagged molecules that are covalently bound to chemically reactive groups provided for chain terminators. A process for producing nucleic acid sequences having decreased thermodynamic stability to complementary sequences is also provided and achieved by this invention. Unique nucleic acid polymers are also disclosed and provided in addition to other novel compositions, kits and the like.

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# EUROPEAN SEARCH REPORT

Application Number  
EP 99 11 2181

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X	WO 92 00989 A (ICI PLC) 23 January 1992 (1992-01-23) * abstract * * page 2, paragraph 5 - page 17 * * claims 1-17 *	33-45	C12Q1/68 C12P19/34
D, X	AUER T ET AL: "SELECTIVE AMPLIFICATION OF RNA UTILIZING THE NUCLEOTIDE ANALOG DITPAND THERMUS THERMOPHILUS DNA POLYMERASE" NUCLEIC ACIDS RESEARCH, OXFORD UNIVERSITY PRESS, SURREY, GB, vol. 24, no. 24, 1996, pages 5021-5025, XP002916438 ISSN: 0305-1048	46, 47	
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 10 November 2003	Examiner Madlener, M
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			



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Y	US 5 270 184 A (WALKER GEORGE T ET AL) 14 December 1993 (1993-12-14) * abstract * * claim 1 *	1-32	
Y	US 5 470 723 A (JURGENSEN STEWART R ET AL) 28 November 1995 (1995-11-28) * abstract * * column 3, line 49 - column 7, line 36 * * figure 1 *	1-32	
Y	WILTON ET AL: "SNAPBACK SSCP ANALYSIS: ENGINEERED CONFORMATION CHANGES FOR THE RAPID TYPING OF KNOWN MUTATIONS" HUMAN MUTATION, WILEY-LISS, NEW YORK, NY, US, vol. 11, 1 March 1998 (1998-03-01), pages 252-258, XP002094957 ISSN: 1059-7794 * abstract * * table 1 * * page 253, right-hand column * * page 254, right-hand column * * figures 1,3 *	1-32	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
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EPO FORM 1503 03.82 (P4/C01)



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Y	<p>WALKER G T ET AL: "STRAND DISPLACEMENT AMPLIFICATION - AN ISOTHERMAL, IN VITRO DNA AMPLIFICATION TECHNIQUE"</p> <p>NUCLEIC ACIDS RESEARCH, OXFORD UNIVERSITY PRESS, SURREY, GB, vol. 20, no. 7, 1992, pages 1691-1696, XP002019521</p> <p>ISSN: 0305-1048</p> <p>* abstract *</p> <p>* figures 1,2 *</p>	1-32	
Y	<p>KURFURST ET AL:</p> <p>"Oligo-.alpha.-deoxyribonucleotides with a modified nucleic base and covalently linked to reactive agents"</p> <p>TETRAHEDRON, ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 49, no. 32, 6 August 1993 (1993-08-06), pages 6975-6990, XP002117189</p> <p>ISSN: 0040-4020</p> <p>* page 6975 - page 6976, paragraph 1 *</p>	3,10,13,14	
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
MUNICH		10 November 2003	Madlener, M
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone</p> <p>Y : particularly relevant if combined with another document of the same category</p> <p>A : technological background</p> <p>O : non-written disclosure</p> <p>P : intermediate document</p> <p>T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p>			

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Place of search MUNICH		Date of completion of the search 10 November 2003	Examiner Madlener, M	
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A	SANGHVI Y S: "HETEROCYCLIC BASE MODIFICATIONS IN NUCLEIC ACIDS AND THEIR APPLICATIONS IN ANTISENSE OLIGONUCLEOTIDES" ANTISENSE RESEARCH AND APPLICATIONS, CRC PRESS, GB, 1993, pages 273-288, XP002921486 * the whole document *	46, 47	
P, X	WO 98 43991 A (AMERSHAM PHARM BIOTECH UK LTD ;SIMMONDS ADRIAN CHRISTOPHER (GB); H) 8 October 1998 (1998-10-08) * abstract * * page 1, line 1 - page 14, line 25 * * example 3 * claims 1-13, in particular claims 11-13 --- -/--	33-35	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 10 November 2003	Examiner Madlener, M
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

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Application Number  
EP 99 11 2181

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
P,Y	<p>HONEYMAN KAITE ET AL: "Development of a snapback method of single-strand conformation polymorphism analysis for genotyping Golden Retrievers for the X-linked muscular dystrophy allele." AMERICAN JOURNAL OF VETERINARY RESEARCH, vol. 60, no. 6, June 1999 (1999-06), pages 734-737, XP001096004 ISSN: 0002-9645 * abstract * * page 734, right-hand column, last paragraph - page 735, left-hand column, paragraph 1 * * page 736, left-hand column, paragraph 2 * * figure 3 *</p>	1-32	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
Place of search <b>MUNICH</b>		Date of completion of the search <b>10 November 2003</b>	Examiner <b>Madlener, M</b>
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

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Application Number  
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**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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**LACK OF UNITY OF INVENTION  
SHEET B**

Application Number

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

**1. Claims: 1-32**

Processes for - linearly or non-linearly - amplifying a specific nucleic acid sequence involving a primer comprising two segments inducing, e.g., hairpin formation during the extension reaction, subsequent binding of a second primer, second primer extension, and displacement of the first primer extension.

**2. Claims: 33-45**

Post-termination labelling process involving the incorporation of terminators.

**3. Claims: 46-47**

Process for producing nucleic acid sequences having decreased thermodynamic stability to complementary sequences and single- or double-stranded nucleic acid polymers involving at least one modified nucleotide (analog) comprising a negatively charged chemical moiety.

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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10-11-2003

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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